REMARKS

This paper is filed in response to the non-final Office action mailed on February 13, 2009. No claims are amended. Claims 68-63 and 79-90 remain pending in the application. Applicant appreciates the Examiner's allowance of claims 85 and 87 and his indication that claims 71, 72, 82 and 83 recite allowable subject matter. In view of the following comments, Applicant respectfully requests reconsideration and allowance of all pending claims.

Claim Rejections – 35 U.S.C. §103

In the outstanding Office action, claims 68-70, 73, 79-81, 84 and 86-90 stand rejected under 35 U.S.C. §103 as being unpatentable over combinations of the prior art. However, to support an obviousness rejection, MPEP §2143.03 requires "all words of a claim to be considered" and MPEP § 2141.02 requires consideration of the "[claimed] invention and prior art as a whole." Further, the Board of Patent Appeals and Interferences recently confirmed that a proper, post-*KSR* obviousness determination still requires the Office to make "a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art." *See, In re Wada and Murphy*, Appeal 2007-3733, citing *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995). Applicant submits that none of the proposed combinations of the prior art discloses every limitation of the pending claims, thereby overcoming the aforementioned rejections, as discussed more specifically below.

Claims 68 and 79 stand rejected as being obvious over the purported combination of U.S. Patent No. 5,671,608 ("Wiggs"), U.S. Patent No. 5,507,315 ("Parker") and U.S. Patent No. 6,403,540 ("Richardson"). Each of independent claims 68 and 79 requires a direct expansion geothermal heat exchange system having a heating mode and a cooling mode. The geothermal heat exchange system requires at least an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in the cooling mode of approximately 305-405 psi and a suction pressure in the heating mode of approximately 80-160 psi. No combination of Wiggs, Parker and Richardson teaches or suggests all of these limitations.

Wiggs is directed toward direct expansion systems near surface conditions which use conventional refrigerants at conventional operating pressures in the heating and cooling modes and is unrelated to sub-surface heat exchange systems of the present application. More specifically, a conventional R-22 system will typically have a head pressure in the cooling mode

of approximately 200-250 psi, and a suction pressure in the heating mode of approximately 50-70 psi. As disclosed in paragraph [0024] of the present application, such conventional refrigerants work well near surface conditions, typically at depths of 100 feet or less, but not for sub-surface heat exchange applications extending to depths beyond 100 feet. At such depths, a refrigerant with a greater operating pressure must be utilized so as to offset the negative effects of gravity. As the Examiner admittedly states on page 2 of the Office action, Wiggs fails to teach or suggest such refrigerant charge parameters, as specified in claims 69 and 79.

The Examiner thus relies upon column 1, lines 26-30 of Parker to purportedly supply Wiggs with "use of more than 400 psi head pressure in a refrigeration system for *optimal* use of head pressure for high pressure refrigerant for the purpose of *efficient* running of the refrigeration system." Applicant respectfully disagrees. While Parker is irrelevant to sub-surface heat exchangers, Parker simply fails to teach or suggest a refrigerant having a head pressure of approximately 305-405 psi in a cooling mode. In fact, column 1, lines 26-30 of Parker teaches pressure differentials, not head pressures, of more than 400 psi. Furthermore, Parker teaches how such high pressure differentials are detrimental to refrigeration systems. For instance, column 1, lines 16-33 of Parker teaches how high pressure differentials may cause "difficult operating conditions" and "significant pressure forces" possibly resulting in "refrigerant leakage" and "frictional forces" which resist valve actuation. In no way does Parker describe the high differential pressures as being *optimal* or *efficient* for refrigeration systems.

The Examiner additionally relies upon column 8, lines 3-4 of Example 2 of Richardson to supply Wiggs and Parker with "use of 90 psi suction pressure ... in a supercritical refrigeration system for the purpose of efficient running of the refrigeration system." However, Richardson is solely directed toward a composition for cleaning and lubricating automotive air conditioners and is unrelated to refrigerants. For instance, the abstract, as well as column 1, lines 8-17 of Richardson specifically states that the Richardson patent is related to "compositions which are useful for cleaning and lubricating air conditioning systems ... as part of a change over of the system from F-12 to a newer non ozone-depleting refrigerant, such as F-134." Furthermore, the "90 psi suction pressure" of Example 2 of Richardson is that of a baseline ester, or pollyol ester. As is well known in the art, pollyol ester is an oiling or lubricating agent and in no way a refrigerant. Moreover, the pollyol ester of Example 2 of Richardson is shown to have a suction

temperature of 28°C, or 82°F. A common refrigerant has a boiling point that is approximately at or below the target cooling temperature, or at least significantly lower than 82°F. Accordingly, the composition tested in Example 2 of Richardson *cannot* be a refrigerant, as it would simply vaporize at such conditions shown.

The proposed combination of Wiggs, Parker and Richardson fails to properly combine, and further, fails to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Accordingly, the obviousness rejection of claims 68 and 79 based upon Wiggs, Parker and Richardson must fail and should be withdrawn.

Claims 69, 80, 89 and 90 stand rejected as being obvious over the purported combination of Wiggs, Parker, Richardson and U.S. Patent No. 6,390,183 ("Aoyagi"). As previously discussed with respect to independent claims 68 and 79, each of claims 69, 80, 89 and 90 similarly requires a direct expansion geothermal heat exchange system having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in the cooling mode of approximately 305-405 psi and a suction pressure in the heating mode of approximately 80-160 psi. No combination of Wiggs, Parker, Richardson and Aoyagi teaches or suggests all of these limitations.

The combination of Wiggs, Parker and Richardson has been previously discussed as failing to properly combine, and further, as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Aoyagi similarly fails to supply all of the deficiencies of Wiggs, Parker and Richardson.

The Examiner relies upon Aoyagi for its use of an R-410A refrigerant. However, Aoyagi still fails to supply a direct expansion geothermal heat exchange system having a refrigerant charged to the parameters specified in the claims. In fact, Aoyagi teaches away from charging or operating a heat exchange system at refrigerant pressures greater than those used with a conventional R-22 refrigerant. Instead, Aoyagi teaches that pressure loss experienced by a refrigerant flowing through the heat exchanger should be minimized. Specifically, Aoyagi states

that the refrigerant should have a greater density so that a lower refrigerant flow velocity may be used to achieve the same operational abilities as conventional R-22. The lower refrigerant flow velocity, in turn, reduces fluid pressure loss, which is the stated goal of Aoyagi. Furthermore, column 3, lines 44-47 and column 4, lines 16-18 of Aoyagi specifically teaches that the refrigerant charge should be reduced. The net effect of these teachings in Aoyagi is a refrigerant having lower operational pressures than systems using a conventional R-22 refrigerant. One of ordinary skill in the art, therefore, would not be motivated by Aoyagi to use a refrigerant at elevated pressures.

The proposed combination of Wiggs, Parker, Richardson and Aoyagi fails to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Accordingly, the obviousness rejection of claims 69, 80, 89 and 90 based upon Wiggs, Parker, Richardson and Aoyagi must fail and should be withdrawn.

Claims 64 and 75 stand rejected as being obvious over the purported combination of Wiggs, Aoyagi and U.S. Patent No. 6,840,058 ("Suzuki"). However, claims 64 and 75 have been canceled, and therefore, the rejection is moot with respect to these claims.

Claims 70 and 81 stand rejected as being obvious over the purported combination of Wiggs, Parker, Richardson and Suzuki. As previously discussed with respect to independent claims 68 and 79, each of claims 70 and 81 requires a direct expansion geothermal heat exchange system having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. No combination of Wiggs, Parker, Richardson and Suzuki teaches or suggests all of these limitations.

The combination of Wiggs, Parker and Richardson has been previously discussed as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Suzuki similarly fails. More specifically, the Examiner relies upon Suzuki for its use of polyester oils as lubricating oil in a climate control system for the purpose of running the climate control system. However, Suzuki

is unrelated to sub-surface heat exchange systems, and further, fails to disclose a direct expansion geothermal heat exchange system having a refrigerant with a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi, as specified in the claims.

As the proposed combination of Wiggs, Parker, Richardson and Suzuki fails to teach or suggest all of the required limitations of independent claims 68 and 79, the obviousness rejection of claims 70 and 81 based upon Wiggs, Parker, Richardson and Suzuki must also fail and should be withdrawn.

Finally, claims 73, 84, 86 and 88 stand rejected as being obvious over the proposed combination of Wiggs, Parker, Richardson and U.S. Patent No. 3,421,337 ("Johannsen"). As previously discussed with respect to independent claims 68 and 79, each of claims 73 and 84 requires a direct expansion geothermal heat exchange system having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Each of independent claims 86 and 88 specifies a method of designing a direct expansion geothermal heat exchange system having a cooling mode and a heating mode. The method requires the steps of providing a refrigerant and charging the system with the refrigerant to obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, and a suction/vapor temperature of approximately 37°F to 55°F. Claim 86 requires an R-410A refrigerant while claim 88 requires a refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi. No combination of Wiggs, Parker, Richardson and Johannsen teaches or suggests all of these limitations.

The combination of Wiggs, Parker and Richardson has been previously discussed as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi, as specified in independent claims 68 and 79. The combination of Wiggs, Parker and Richardson similarly fails to teach or suggest every element of claims 86 and 88. More specifically, none of Wiggs, Parker and

Richardson teaches or suggests a sub-surface direct expansion geothermal heat exchange system with an R-410A refrigerant, or a refrigerant having heating/cooling operational working pressure between 80 psi and 405 psi. Each of Wiggs, Parker and Richardson also fails to teach or suggest a step of charging such a system with a refrigerant to obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, and a suction/vapor temperature of approximately 37°F to 55°F.

Johannsen similarly fails. The Examiner relies upon Johannsen to supply Wiggs, Parker and Richardson with a superheat of approximately 12°F. However, Johannsen is unrelated to sub-surface heat exchange systems, let alone charging such systems to obtain peak operational efficiency in a cooling mode, as specified in each of claims 86 and 88. Specifically, Johannsen does not obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, *and* a suction/vapor temperature of approximately 37°F to 55°F.

As the proposed combination of Wiggs, Parker, Richardson and Johannsen fails to teach or suggest all of the required limitations of independent claims 68, 79, 86 and 88, the obviousness rejection of claims 73, 84, 86 and 88 based upon Wiggs, Parker, Richardson and Johannsen must also fail and should be withdrawn.

CONCLUSION

It is submitted that the present application is in good and proper form for allowance. A favorable action on the part of the Examiner is respectfully solicited. If, in the opinion of the Examiner, a telephone conference would expedite prosecution of the subject application, the Examiner is invited to call the undersigned agent.

The Patent Office is hereby authorized to credit any overpayment or charge any deficiency in the fees filed, asserted to be filed, or which should have been filed herewith to our Deposit Account No. 50-3629.

Dated: August 13, 2009

Respectfully submitted,

By_____
Robin S. O
Registration No.: 60,043
MILLER, MATTHIAS & HULL
One North Franklin Street
Suite 2350
Chicago, Illinois 60606
(312) 235-4763
Agent for Applicant